System Configuration Guide

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1 Introduction

This guide provides detailed procedures for setting up a Spara Go™ system used to manage your facility's electrical energy usage. Perform the setup steps by following the sections in this guide in order.

Definitions

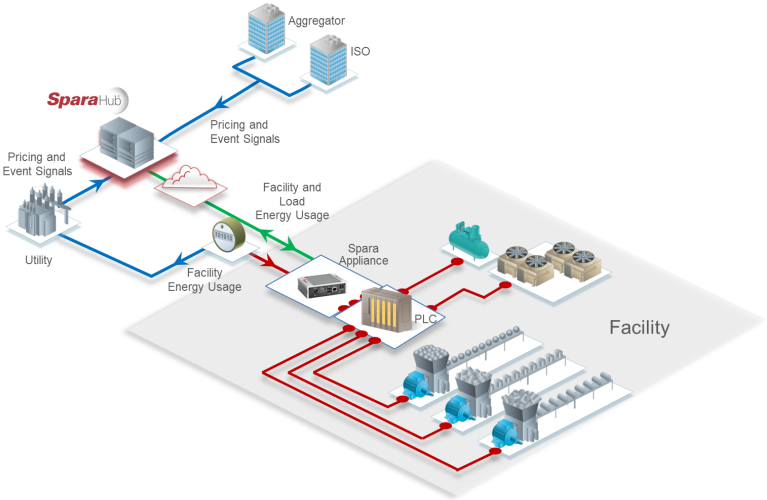
Spara Go application: The software application that collects meter and load data, controls the Spara Go appliance, manages the demand, and communicates with the Spara Hub platform or the Spara View user interface.

Spara Go appliance: The hardware platform that the Spara Go application runs on. The Advantech ARK 1122 is the current Spara Go appliance. **Note**: The Spara Go appliance may be referred to as the Spara DM appliance in the Spara Hub and Spara View user documentation.

Spara Hub®: The cloud-based, full-featured interface to the Spara Go application and appliance.

Spara View®: The local user interface to the Spara Go application and appliance.

System Architecture



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See Also

The Spara Hub documentation link (https://www.sparahub.com/docs/Spara Docs Index.html) provides access to the following documents:

Spara Go Configuration Reference provides the following sections:

- "Using Simulated Data"
- "Setting Pulse Rate"
- "Connecting to the Terminal Interface"
- "Changing Time Settings"
- "Changing Network Communication Settings"
- "Terminal Interface Command Reference"
- "Modbus Map Subset"
- "Spara Go PLC Sample"

Spara Hub User Manual provides information on using the Spara Hub Demand Manager user interface to the plant.

Spara View for Spara Go User Guide provides information on using Spara View web user interface to the plant.

Spara Go Modbus Map provides the complete Modbus map for the Spara Go system.

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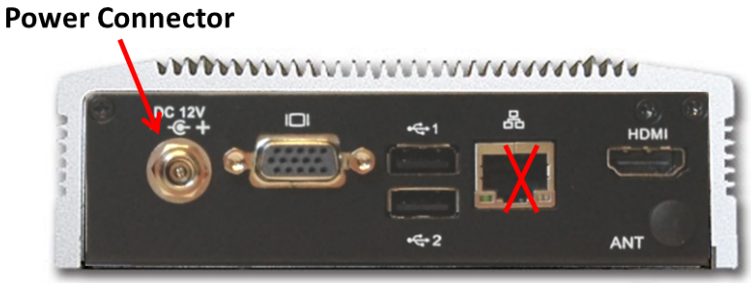
2 Set up the Appliance

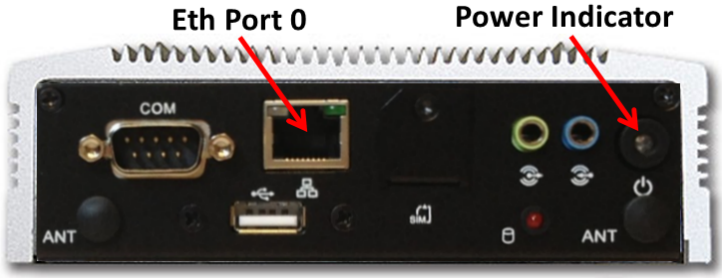
Set up power and internet connection

1. Connect the Spara Go appliance to the provided power supply in a safe location for operation. Most installations will require a protective enclosure rated for the environment.

   Note: A DIN-rail is installed on the appliance for easy mounting. You can remove the rail by removing four screws if you need to install the appliance another way. Optional wall-mounting hardware (bracket, screws, allen wrench) is included with the Spara Go system.



2. Turn on power to the appliance by plugging the power supply into a 115VAC receptacle and verify the appliance is powered on by observing the green power on status light.
3. Connect an Ethernet cable between your network (LAN) that has internet access and Eth Port 0 on the appliance. **Note**: For Spara Go to be fully functional it needs to be connected to Spara Hub via the internet. There are two Ethernet ports on the appliance, but only Port 0 is configured to connect to Spara Hub.



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Notes:

The default network configuration setting for Eth Port 0 is DHCP. If your network is not set up for DHCP, see "Connecting to the Terminal Interface" in the *Spara Go Configuration Reference* to configure a static IP address for Eth Port 0.

Your network must support the following: Secure and encrypted data and management channel initiated by the Spara appliance to the Spara Hub user interface via SSL/TLS VPN - Port 1194.

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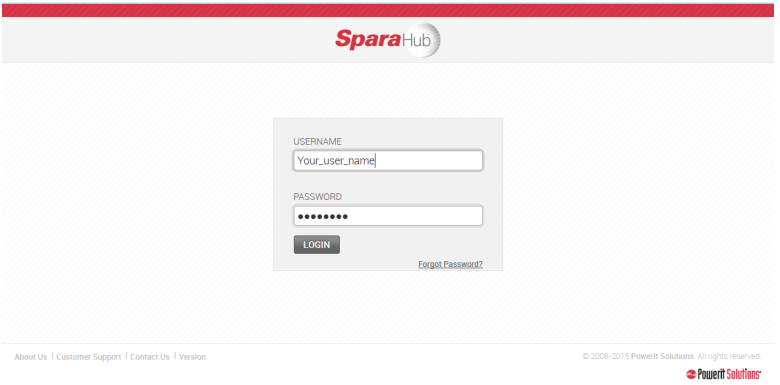
3 Verify Spara Hub Connection

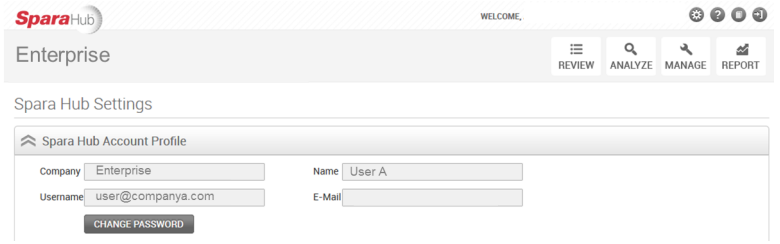
Spara Hub is the primary, cloud-based user interface for the Spara Go system. In this section you will start the Spara Hub interface and verify the connections and that the Spara Go system is registered with Spara Hub.

Connect to Spara Hub

1. In a browser, navigate to www.sparahub.com and log in using the credentials provided with your Spara Go appliance.



2. You will be prompted to change your password before you use Spara Hub.



3. Log in using the new password.

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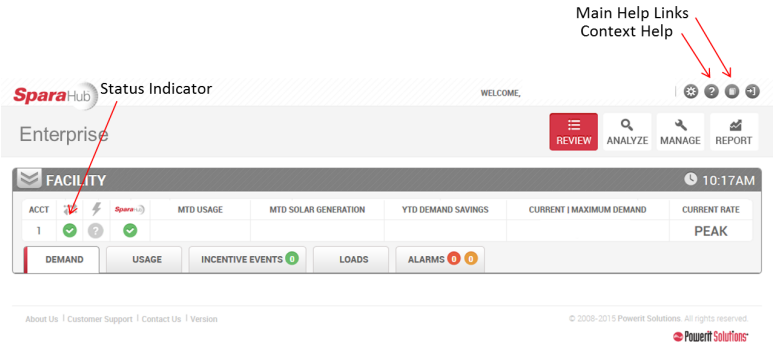
Confirm the Connection

1. The main page will look similar to the following. **Note**: Click the help link for more information on this feature.



2. Confirm the connection between Spara Hub and the Spara Go appliance by checking the status indicators. **Note**: It may take up to 5 minutes for the connection status to update. The indicator on the left should be a checkmark, as shown in the screenshot.
3. If the status indicator is as shown, the connection between Spara Hub and the Spara Go appliance is working properly. Continue with the configuration steps. If the status indicator is not as shown, the connection is not working properly; see Troubleshooting.

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4 Configure Display Settings

In this section, you can customize some basic settings for your system:

- Change the names of any of the labels to names that are meaningful at your facility.
- Enable and disable Spara Go management for individual loads, so that the **Loads** displays are filtered to show only enabled loads.

Simulation

You can set the system to produce simulated data if you want to familiarize yourself with the interface before customizing the display and before completing Modbus integration. To do so, you must enable simulation mode in the Spara View interface. Spara View is the interface local to the Spara Go appliance. It is typically used to provide access to the data and settings when circumstances (e.g., internet outage) prevent access to the internet and the Spara Hub interface. It includes the optional Simulation mode setting.

If you want to look at simulated data, follow the instructions in the "Using Simulated Data" section in the *Spara Go Configuration Reference*. Click the button in Spara Hub to find a link to the document.

Note: When you are ready to continue with this section, be sure to disable simulation mode, and return here.

Node Hierarchy

The data supplied in the Spara Hub interface is organized in a hierarchy of nodes from the company to the load as follows:

- "Enterprise" is the company.
- "Facility" is the building, location, branch, etc., where Spara Go is installed.
- "Utility Acct #" is the utility account for the loads that Spara Go is managing. There can be only one utility account (and one utility account bill) for each Spara Go appliance. Some facilities may have multiple utility accounts.

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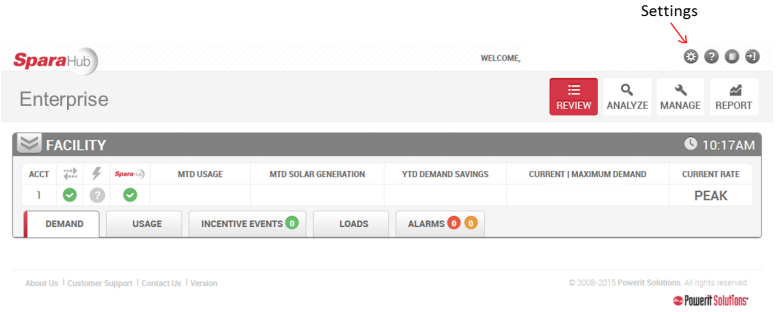
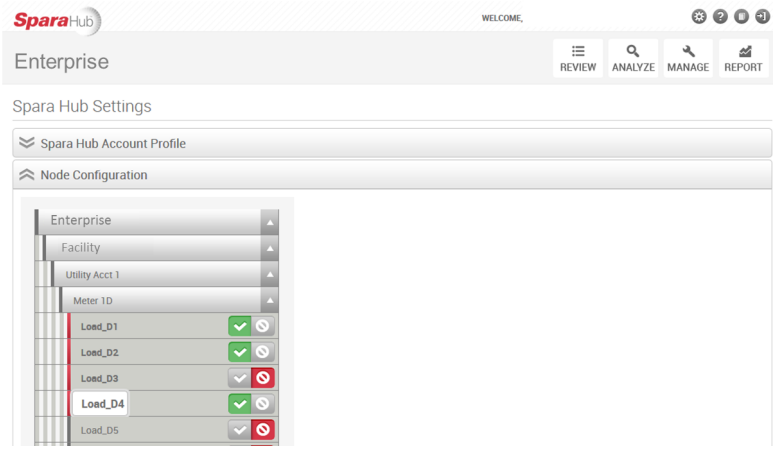
- "Meter #" is the electrical meter for the loads. Spara Go supports two meters. If the account has more than two meters, they must be combined in another plant automation system (e.g., PLC) before communicating with Spara Go.
- "Load #" is the equipment that Spara Go is managing. Up to 10 digital and 10 analog loads are supported. E.g., fans, freezers, heaters, furnaces, etc. Default names for the digital loads are Load_D1, Load_D2, and so on. Default names for the analog loads are Load_A1, Load_A2, and so on.

Customize Display

1. Click the Spara Hub Settings icon.



2. Expand the **Node Configuration** section.



3. To change the name of any node, click in the field and edit the name. After making your changes, click **Accept**.

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4. To enable or disable a load, and thus filter which loads are shown in the other Spara Hub displays, click the appropriate button. indicates that the load is enabled. indicates that the load is disabled. After making your changes, click **Accept**.
5. If the time shown in the display is incorrect, after completing other setup steps, see the *Spara Go Configuration Reference* for instructions.

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5 About Modbus Integration

You must have an understanding of the Modbus protocol to perform Spara Go Modbus integration. If you do not, before proceeding, please visit www.modbus.org to research the publicly available documentation.

Spara Go functions as a Modbus/TCP server (e.g., slave). It allows use of function code 03 to read from and function code 16 to write to holding registers (4XXXXX). It allows use of function code 04 to read from input registers (3XXXXX). Writing to input registers is not allowed.

You must configure Modbus TCP communications with the Spara Go appliance to provide feedback and control at your facility. See the Spara Go Modbus Map (provided in the Spara Hub documentation link) for reference information for all register descriptions and address locations. You must also configure your PLC or other automation communication to interact with the appropriate Modbus address locations.

Logical Structure

The Spara Go Modbus Map is logically structured into three major groups as follows:

- Utility account control parameters and operating values (Modbus address range 15001-17000)
- Individual utility meter control parameters and operating values (Modbus address range 17001-20000)
  - Spara Go supports input from either one or two utility meters with similar data and parameter structures for each meter.
  - The Modbus Map data structure is similar for each meter with an address index of 50. (i.e., Meter 1 60 second average power (kW) is found at address 17011, Meter 2 is found at address 17061)
- Individual load control parameters and operating values (Modbus address range 1-15000)
  - Spara Go supports up to 10 discretely (on/off) controlled loads with similar data and parameter structures for each load.

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- Loads identified as 1-10 correlate to the 10 discretely controlled loads.
- Spara Go supports up to 10 analog controlled (0-100%) loads with similar data and parameter structures for each load.
- Loads identified as 11-20 correspond to the 10 analog controlled loads.

Modular Data Types

- *Boolean* parameters have two values: 0 or 1 (i.e., False or True)
- *Short* parameters are 16-bit integers.
- *Int* parameters occupy two sequential register locations.
  The first register contains the low (least significant) word.
  The second register contains the high (most significant) word.
- *Float* parameters occupy two sequential register locations and must be correctly addressed using the IEEE standard.
  The first register contains the low (least significant) word.
  The second register contains the high (most significant) word.

See Also

On the Spara Hub Documentation page:

"Modbus Map Register Subset" in the *Spara Go Configuration Reference.*

*"*Spara Go PLC" in the *Spara Go Configuration Reference* for a sample PLC program for Spara Go systems.

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6 Connect to Meters

In order for Spara Go to be able to accurately control a facility's peak demand, Demand Response event participation, and reaction to Dynamic Pricing, Spara Go must be connected via Modbus/TCP to a real time kWh feed from the facility's utility meter(s). This provides Spara Go the visibility of the overall consumption of the facility, which is what the facility's utility bill is based upon. It also allows Spara Hub to provide overall kWh and kW analytics. Spara Go provides the capacity to connect up to two separate utility meters which add up to the overall facility's utility bill.

Modbus/TCP Integration

Spara Go uses Modbus/TCP to integrate the facility's utility meters. This is by done by writing an accumulating pulse count into the Total Energy holding registers shown below for each meter. Although two counts per meter are available (i.e., integration of a KYZ pulse from a utility meter), only one pulse count is required. The kWh/pulse scaling multiplier must be written into the Scaling Multiplier register defined below to ensure that kWh values are being used by Spara Go and not just counts. If you want to set this value in the Spara view user interface instead of through Modbus, see "Setting the Pulse Rate" in the *Spara Go Configuration Reference*. If an actual kWh count is being used, then no change is required, and the Scaling Multiplier can remain at the default value of 1.

Note: Total Energy count **must** count up to the full 32-bit integer value and not roll over beforehand. If it rolls over before counting up to the full count, an error will occur and some kWh counts will not be calculated correctly.

Type	Address	Type	Description		Unit
Holding R/W	17001	Int	Meter 1	Total Energy - kWh Pulse Count 1	Counts
Holding R/W	17003	Int	Meter 1	Total Energy - kWh Pulse Count 2 (Optional)	Counts
Holding	17009	Float	Meter 1	Scaling Multiplier	kWh/pulse

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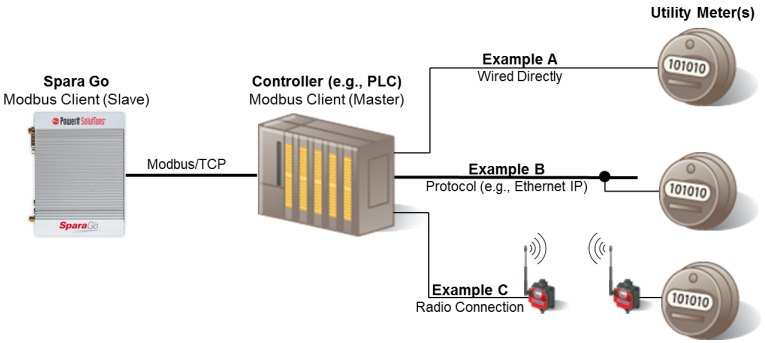
R/W					
Holding R/W	17051	Int	Meter 2	Total Energy - kWh Pulse Count 1	Counts
Holding R/W	17053	Int	Meter 2	Total Energy - kWh Pulse Count 2 (Optional)	Counts
Holding R/W	17059	Float	Meter 2	Scaling Multiplier	kWh/pulse

Examples

There are multiple ways in which a facility can integrate the utility meter into Spara Go, shown as Examples A, B, and C below.



Example A

This configuration shows the connection of a PLC or similar controller directly to a utility meter's pulses. This would typically be directly wired through dry contacts at the meter to a digital input counter at the controller. These contacts are typically available by contacting the facility's local utility and requesting a "KYZ pulse output" to be installed at the meter(s). During the installation process, you will also need to acquire the pulse multiplier or pulse weight (kWh/pulse) from the utility. This value used in the Spara Go software as described in the "Modbus/TCP Integration" section above.

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Example B

This configuration shows the connection of a PLC or similar controller to a meter with the capability of communicating over Ethernet. In this case, a facility may choose to install a “shadow” or parallel meter(s) with the utility meter. It is recommended that this meter be a revenue meter to ensure accuracy in relation to the utility meter that the facility is being billed from. The controller would then communicate over Ethernet to the meter to acquire kWh consumption data via any number of various protocols that the controller may be capable of (Modbus/TCP, Ethernet IP, etc.). In this scenario, a pulse multiplier is not necessary because the values should be in actual kWh and not pulse counts.

Example C

This configuration shows the use of a radio transmitter and receiver to communicate to the meter. This can be an inexpensive solution for connecting the controller to the meter, considering that the utility’s meters are often located in inconvenient locations. The connection at either end of the radios may be a combination of Option A or B.

6.1 Testing and Verification

Once the meter(s) have been integrated, confirm that meter data is appearing in Spara Hub:

1. In a browser, navigate to www.sparahub.com and log in.
2. Open the **Review** - **Demand** tab. Observe the page and verify that meter data appears.

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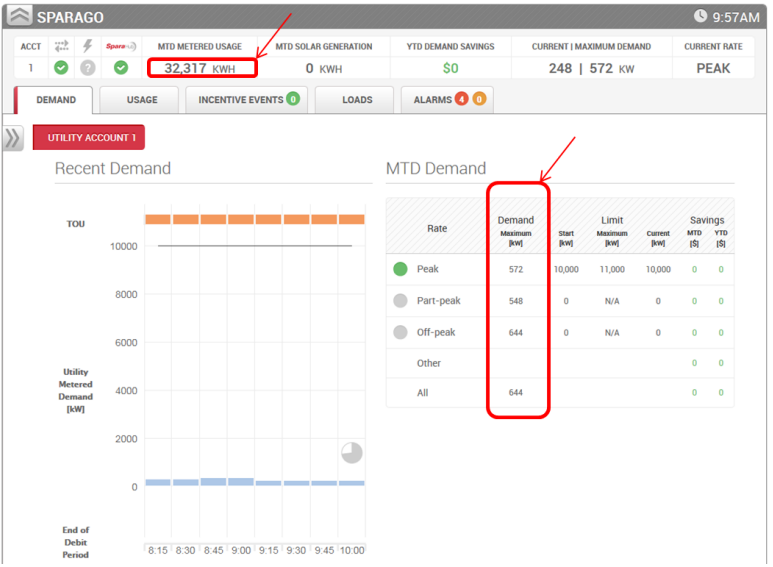

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7 Connect to Loads

In order for Spara Go to be able to accurately control a facility's peak demand, Demand Response event participation, and reaction to Dynamic Pricing, Spara Go must be connected via Modbus/TCP to the loads in the facility. Loads may include fans, pumps, compressors, furnaces, battery chargers, etc.

Modbus/TCP Integration

Spara Go uses Modbus/TCP to integrate the facility's loads. This is done by reading from / writing to the Modbus registers listed in the table below. At a minimum, Spara Go requires integration of Load Status Feedback and Load Reduction Signal for each load. This gives Spara Go visibility into the energy use of the load as well as the ability to automatically reduce the energy use.

Spara Go requires load status feedback via the Modbus map, either by an on/off status for discrete loads or by kW feedback for analog loads. The Spara Go logic automatically determines how to use the discrete status or kW feedback.

Spara Go produces a Reduction Signal for each controlled load via the Modbus map. This signal will be used to coordinate a safe reduction (i.e., turning down or off) of the load through its existing controller.

There are also additional features, such as constraint inputs, which, when compared to a constraint setpoint, will restrict the reduction of the loads based on process restrictions related to that load. For example, connecting to an HVAC load, monitoring the temperature of a room, and writing the current value to the Analog Constraint.

Type	Addr*	Type	Load	Description	Notes
Holding R/W	1 101 ... 901 1001 1101	Float	D1 D2 ... D10 A1 A2	Status Feedback	Discrete Controlled Loads: The current status of the Load. 0=Off, 1=On Analog Controlled Loads: The current power consumption of the

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	... 1901		... A10		load. E.g., 75 kW.
Holding R/W	6 106 ... 906 1006 1106 ... 1906	Float	D1 D2 ... D10 A1 A2 ... A10	Analog Constraint	Analog constraint will prevent the load from entering or continuing a reduction when the value is above or below a specified setpoint. E.g., a temperature setpoint. The setpoint and deadband can be set for each load on the Spara Hub Manage - Loads page.
Holding R/W	8 108 ... 908 1008 1108 ... 1908	Short	D1 D2 ... D10 A1 A2 ... A10	Discrete Constraint	Discrete constraint will prevent the load from entering or continuing a reduction when the value is high. E.g., a level switch.
Holding R/W	5 105 ... 905 1005 1105 ... 1905	Short	D1 D2 ... D10 A1 A2 ... A10	Force Reduction	When high, forces the load to reduce regardless of energy consumption and setpoint level.

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Input Read only	1 101 ... 901 1001 1101 ... 1901	Bool	D1 D2 ... D10 A1 A2 ... A10	Reduction Signal	Use this value to trigger a load reduction. When the value is 1, the load will be turned off or put into a low power consumption mode.
Input R/W	1002 1102 ... 1902	Float	A1 A2 ... A10	Reduction Percentage (%)	Analog Controlled Loads Only: Use this value in combination with the Load Reduction Signal bit. When Load Reduction Signal is 1, use this percentage to set the level of kW that the load should be reduced to.

* For every loads register, Discrete loads (e.g., D1 - D10) use the first 1000 addresses (e.g., 1-1000); Analog loads (e.g., A1 - A10) use the second 1000 addresses (e.g., 1001-2000). The addresses for each load are separated by 100. Thus Load 1 Status Feedback is address 1; Load 2 Status Feedback is address 101; Load 3 Status Feedback is address 201, etc.

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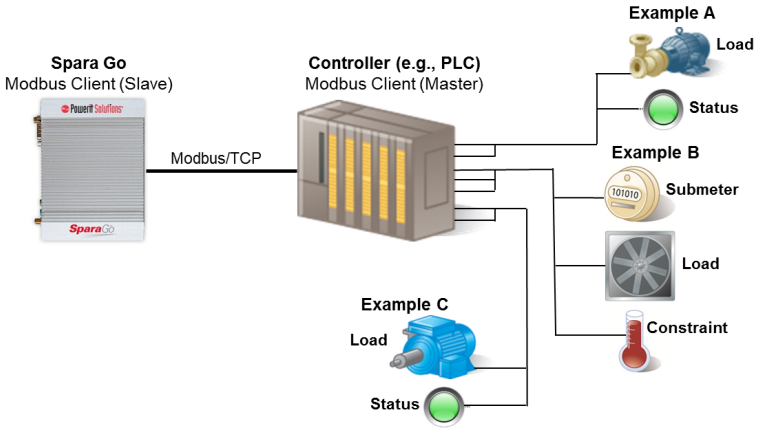
Examples



Example A – Load currently wired/integrated to controller

Load Status Feedback (e.g., starter aux contact – On/Off): Load status is already present in the controller. Pass this status to Spara Go via Modbus/TCP.

Load Reduction Signal: Load status is already present in the controller. Pass this status to Spara Go via Modbus/TCP.

Example B – Load currently wired/integrated to controller with submeter and constraint

Load Status Feedback (e.g., submeter kW): Load status is already present in the controller as a kW value. Pass this status to Spara Go via Modbus/TCP.

Load Reduction Signal: Adapt existing controller logic to use load reduction signal = 1 to safely reduce or turn off the load (e.g., fan).

Analog Constraint: Pass a monitored value (e.g., temperature) that is associated with the load (e.g., fan) to Spara Go via Modbus/TCP. Spara Go will use this to restrict the reduction of the load based on the current value of that load with respect to a setpoint configured in Spara.

Example C – Load not currently wired/integrated to controller

Load Status Feedback (e.g., starter aux contact – On/Off): Wire status signal directly from load (e.g., motor) to digital input on controller. Pass this status to Spara Go via Modbus/TCP.

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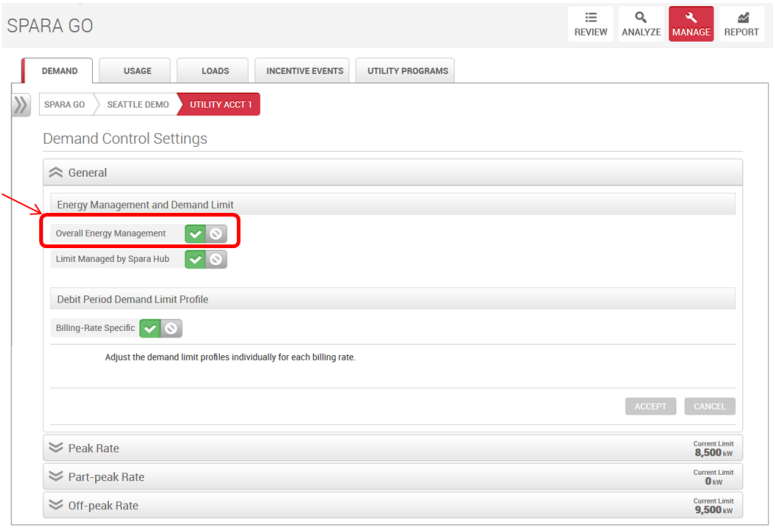
Load Reduction Signal: Wire normally closed contact relay in series with start/stop circuit for the load starter coil. Turn on relay based on load reduction signal from Spara Go.

7.1 Testing and Verification

Once the load(s) have been integrated, confirm that the loads can be managed by Spara Hub:

1. In a browser, navigate to www.sparahub.com and log in.
2. Enable Energy Management.
   a. Open the **Manage** - **Demand** tab.
   b. In the **General** section, enable **Overall Energy Management**, then click **Accept**.

   Note: If you want to disable Spara Hub management and use the Spara View user interface, which is local to the Spara Go appliance, you can do so on this tab.



3. Expand the section for the current Time of Use period (e.g., Peak). If the **Start** value for the **Demand Control Limit** for the current month is not set to a high enough value to prevent automatic reductions, set it to a high value and then click **Accept**.

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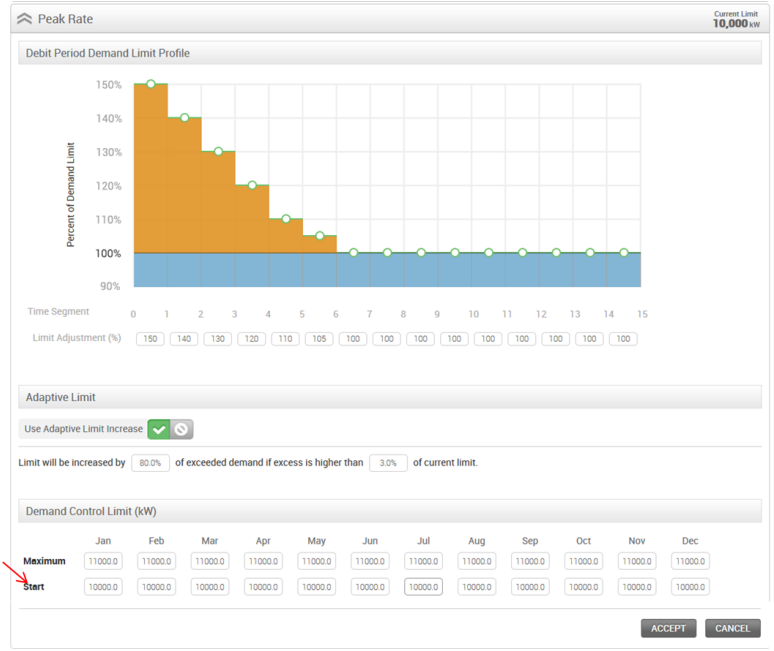
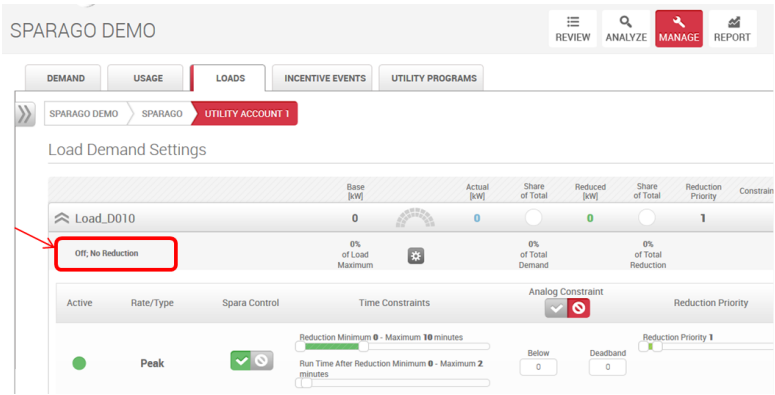


4. Verify the Status Feedback signal.

   a. Open the **Manage** - **Loads** tab.

   b. Navigate to the utility account.

   c. Expand each load and verify that the status listed ("Running" or "Off") and its associated kW represent the actual status of the load.



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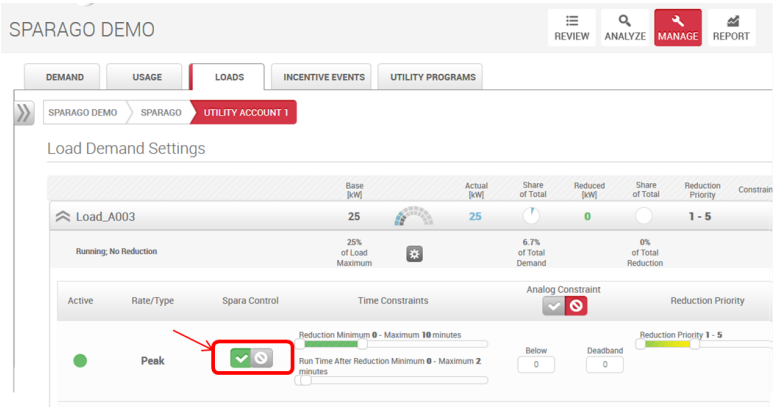
5. Verify the Reduction Signal value. For each load:
   a. Open the **Manage - Loads** tab.
   b. Navigate to the utility account.
   c. Make sure that Spara Control is enabled. If it is not, enable it and then click **Accept**.



   d. Open the **Review - Loads** tab and observe the power consumption (kW) values.
   e. Set the Modbus Force Reduction signal to 1 for that load (see Connect to Loads).
   f. Verify that the Modbus reduction has occurred in Spara Hub..
   g. Look at the value of the load Reduction Signal Modbus register - the value should be 1.
   h. (Analog loads only) Look at the value of the load Reduction Percentage Modbus register - the value should be 0.
   i. Verify that the load has been reduced.
   j. **IMPORTANT**: Set the Modbus Force Reduction signal to 0.
6. Open the **Manage - Demand** tab. In the **General** section, disable **Overall Energy Management**, then click **Accept**. **Note**: After configuring the load and account settings, you will re-enable **Overall Energy Management**.

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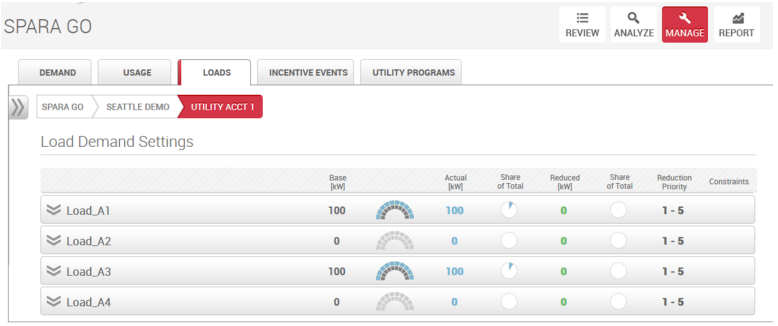
8 Configure Demand Management Settings for Loads

Basic and advanced settings are provided for managing the loads. Advanced features are not discussed in this guide. Click the Spara Hub help links or for more information on all features.

Configure Basic Load Settings

1. In a browser, navigate to www.sparahub.com and log in.
2. Open the **Manage** - **Loads** tab.
3. Navigate to the utility account.



4. Expand each load and view the settings.

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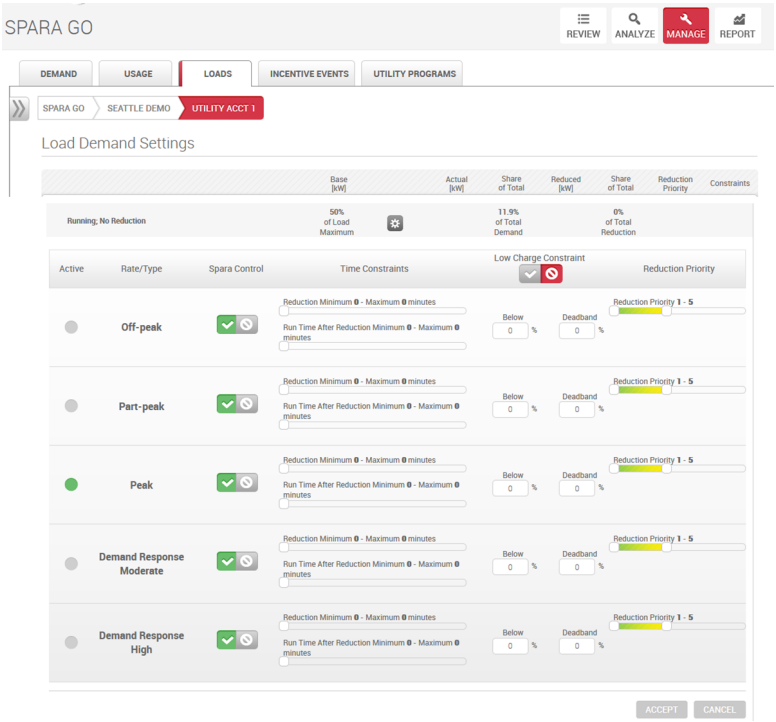

5. For each load, enable or disable control for each Time of Use (TOU) period.

6. For each load, click and set the minimum and maximum power (kW).

   - Analog loads (controlled by 0-100% reduction signal):
     Max. Power is the power which the load is not expected to exceed.
     Min. Power is the minimum power below which the load cannot be reduced.

   - Discrete loads (controlled by on/off reduction signal) with analog power feedback:
     Max. Power is the power level when the load is considered to be ON.
     Min. Power is the power level when the load is considered to be OFF.

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7. You can also:
    - Set time constraints.
    - Specify the reduction priority.
    - Specify the minimum and maximum power for the load.
    - Change analog constraint levels and status. **Note**: Ensure that constraint values are being communicated correctly via Modbus (see Connect to Loads).

    Click the help link for more information on these features.
8. Click **Accept** to save the settings.

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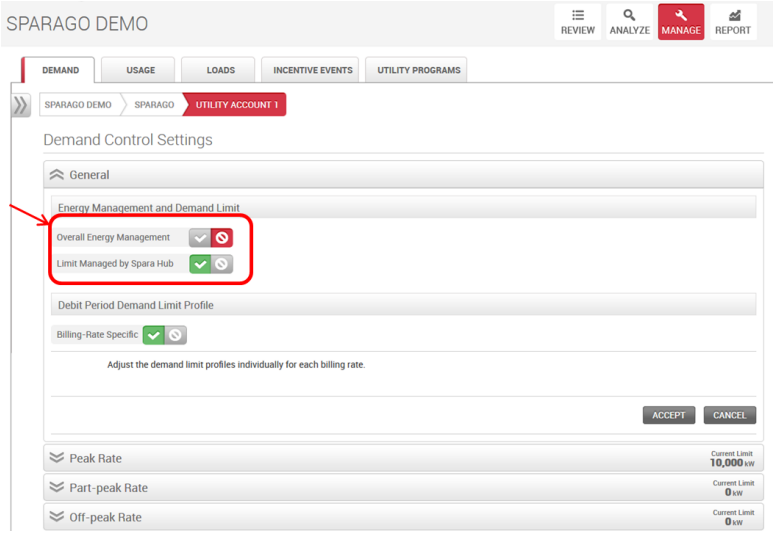
9 Configure Demand Management Settings for Account

A variety of settings are provided for managing all the loads in a utility account. This section guides you in enabling energy management and setting basic demand control limits. Advanced features are not discussed in this guide. Click the Spara Hub help links or for more information on all features.

Configure Settings for the Account

1. If Spara Hub is not open, navigate to www.sparahub.com and log in.
2. Open the **Manage - Demand** tab.
3. Navigate to the utility account for your facility.



4. In the **General** section, the **Energy Management and Demand Limit** settings control whether or not the loads in the utility account are being managed by Spara Go and whether Spara Hub or Spara View is managing the limits. Verify the settings, as shown above.

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5. Under **Demand Control Limit**, set the demand management setpoints.

   a. Demand Control: Set starting limits for each Time of Use (TOU period (e.g., Peak). If you are unsure where to begin, use these general guidelines:

      - 10% below Peak Demand (kW) on the monthly bill.

        – or –

      - Peak Demand (kW) on the monthly bill minus 25-50% of total of the loads connected to Spara Go. The % value depends on the availability of loads for reduction.

   b. Demand Response: Set the limit based upon the facility's specific baseline (calculated by the utility or aggregator) minus the demand response bid level.

6. For each set of changes, click **Accept** to save the settings.

7. When you are ready to use the system to manage demand, enable **Overall Energy Management**, and click **Accept** to save the settings.

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10 Troubleshooting

Status indicator in Spara Hub is not green

- The appliance power must be on.
- The Ethernet cable must be connected to Eth Port 0.
- Your network must be connected to the internet.

Your network must support DHCP or you must have set a static route. (IP address, default gateway, and DNS server) for the appliance Eth Port 0. See "Connecting to the Terminal Interface" and "Changing Network Communication Settings" in the *Spara Go Configuration Reference*.

- If you set a static route, see if you can successfully ping the appliance using the IP address that you set.

The time shown in Spara Hub is not right

- You can change the time zone and the NTP server. See "Connecting to the Terminal Interface" and "Changing Time Settings" in the *Spara Go Configuration Reference*.

There isn't any power data in the Spara Hub displays

- The utility meter must have a connection to a PLC or similar controller. That controller must be connected to your network.
- The Modbus/TCP integration for the meters must be complete. See Connect to Meters.

Modbus is set up for meters and loads, but when I set Force Reduction high, nothing changes.

- Display the Spara Hub **Manage**/**Demand** page and verify that **Overall Energy Management** is enabled.
- Display the Spara Hub **Manage/Loads** page and verify **that Spara Control** is enabled for the loads.

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There is data in the displays, but the values don't look quite right

- The utility company pulse rate must be set correctly. Check the Modbus register; see Connect to Meters.
- The NTP server must be set correctly. See "Connecting to the Terminal Interface" and "Changing Time Settings" in the *Spara Go Configuration Reference*.

There aren't any loads displayed on the loads pages

- Display the **Node Configuration** section on the Spara Hub **Settings** page and make sure the individual loads are enabled.

It doesn't look like the loads are being managed

- Display the Spara Hub **Manage**/**Demand** page and verify that **Overall Energy Management** and **Limit Managed by Spara Hub** are both enabled.
- Display the Spara Hub **Manage/Loads** page and verify **that Spara Control** is enabled for the loads.
- Display the Spara Hub **Manage/Loads** page and click the load settings button . Check the maximum and minimum power settings.

I don't know what a Spara Hub display is showing me

- Click the "Help on this page" link for information on the page.

I need help!

- Your Spara Go system includes a defined amount of technical support. Please submit a support request at: http://www.poweritsolutions.com/service/service_request/

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